A

Synopsis for the Ph.D. thesis entitled:
"HOLISTIC DESIGN OF SEWER AND TRASH MANAGEMENT OF TULJAPUR: PILGRIM TOURISM CITY"

To be submitted to

SWAMI RAMANAND TEERTH MARATHWADA UNIVERSITY, NANDED

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Introduction:

Indian Pilgrim towns known for its festivities and temples have far more occasions of waste generation than other places in the country because of regular temple tourism activities and different religious occasions celebrated around the year. The heavy influx in pilgrim towns leads to creation of the huge amount of solid waste besides causing various environmental problems. But since temple tourism activities are very important for social and cultural aspects of our society and also for the fact that they are the primary source of economy of these temple towns it is very important to find panacea to this problem.

This floating population with a resident population is the primary stockholder of solid waste generation. This waste causes damage to historic sites in the town and also inconvenience to the stockholders. Hence the aim of this research is to prepare a holistically design sewer and trash management of Tuljapur tourism city by reviewing relevant literature for research methods to assess and quantify waste, by understanding contextual needs of the site to have a bottom up approach to the problem**.**

Review of Literature and development in the subject:

The Collection and disposal of garbage/ waste has a long history. The first organized dump was been set up outside Athens in 500 BC. Citizens were asked to dump no closer than miles from the city's limit, this was a much more sophisticated approach than that of the Persians, who till 14th Century were still tossing their trash out of window. The attitude towards solving the huge growing bulk of garbage is vague and when this accumulation reaches a saturation of unbearable level, the public and the government authorities start talking about air and water contamination, health hazards, methane gas leakages, sheer ugliness and slowly initiate action. It has so far been curative and not preventive, as it has to be, in order to be effective (Krishnamoorthy, Environmental Management, 2009)

Across India, the production of waste differs in characteristics depending mainly on the size of the population. What is noteworthy is that the biodegradable fraction is quite high in Indian MSW. The ash and fine earth content is also high due to the practice of inclusion of street sweeping, drain silt and construction and demolition debris in MSW. Waste management

encompasses planning, engineering, organization, administration, financial and legal aspects of activities associated with generation, storage, collection, transfer and transport, processing and disposal of solid wastes in an environmentally compatible manner adopting principles of economy, aesthetics, energy and conservation. Although there is an adequate legal framework existing in the country to address solid waste management issues, what is lacking is its implementation. Likely reasons for poor implementation could be a combination of social, technical, institutional and financial issues.

This study will propose an alternative approach to waste management since the waste will neither be land filled nor burnt but would be used as a resource that will be recycled. It will throw light on reducing volume of temple waste which would eventually generate additional revenues for temples. Floral waste utilization would eventually be beneficial to the society as people would get to live in a cleaner and a healthier environment

Waste Generation and Characterisation:

The municipal authorities in most of the Indian towns do not weigh the refuse vehicles regularly but estimate the quantities on the basis of number of trips made by the collection vehicle. Database on solid waste generation/collection is seldom maintained. It is estimated that solid waste generated in small, medium and large cities and towns in Indian is about 0.1 kg, 0.3-0.4 kg and 0.5 kg per capita per day respectively. Studies carried out by National Environmental Engineering Research Institute (NEERI) indicated that the per Capita Generation rate increases with the size of the city and varies between 0.3 to 0.6 kg/d. Waste generation rate in Indian cities ranges from 200 to 870 grams/day, depending upon the region‟s economy, lifestyle and the size of the city. The Estimated annual increase in per capita waste quantity is about 1.33% per year (Shekdar, 1999).

The Census of India classifies cities and towns into 4 classes, Class 1, Class 2, Class 3, and Class 4, depending upon their population Class 1 cities were further categorized as Metropolitan, Class A, Class B, etc, until Class H depending upon the population of these cities. However, between Class A, B, C, D, E, F, G & H cities the waste generation rates did not vary extremely. They fell in a narrow range of 0.43-0.49 kg/person/day. They generated significantly less MSW per person compared to the six metropolitan cities (0.6 kg/day). India‟s urban population provides

a fair estimation of the average per capita waste generation in Urban India (0.5 kg/day). (Annepu, 2012)

Principles Governing Waste Management

Management of municipal solid waste and adoption of processing technologies are dependent on the quantity and characteristics of the total waste generated in the city/village, the financial resources and in-house efficiency of local authorities to monitor project implementation. ISWM is a strategic approach to manage MSW in a sustainable manner by considering all aspects of MSWM viz. generation, segregation, transfer, sorting, treatment, recovery and disposal in an integrated manner, with an emphasis on maximizing resource use efficiency.

The ISWM concept, is closely linked to the 3R approach (Reduce, Reuse, and Recycle), which is also aimed at optimizing the management of municipal solid waste from all the waste-generators (households, commercial and institutional establishments, parks and gardens , construction and demolition activities, urban agriculture, pilgrim places, tourist spots safety and healthcare facilities) and involving all the stakeholders (waste generators, service providers, informal sector, regulators, government, and community/neighborhood). The adoption of the 3R concept helps to minimize the amount of waste to be handled by the municipal authority minimizing the public health and environmental risks associated with it.

Policies, Programmes and Legal Framework:

Policies, programs and guidance that are related to solid waste management. The ULB shall prepare a list of all mandatory and recommendatory actions required as per the MSW (M&H) Rules, 2000; draft revised MSW (M&H) Rules, 2013, the National Urban Sanitation Policy, the Service Level Benchmarks for MSWM service provision, the Fertilizer Control Order (FCO) 2009, 2013 and other relevant policy guidance and ensure that the MSWM action plan is developed within these framework conditions.

Regional SWM facilities:

Facilitating establishment of regional facilities and promoting decentralized Waste management facilities, as appropriate, should be included in the key provisions of the state level

strategy. Regional approach facilitates establishment of MSW processing and disposal facilities for ULB clusters. Regional systems benefit both large municipal bodies, which experience scarcity of land resources, as well as smaller municipalities, which are challenged by limited technical and financial resources for establishing own facilities.

Institutional Aspects of Regional Approaches: A regional facility entails an institutional arrangement that enables the association of partnering municipalities to provide specific solid waste management services. Some of the attributes of a regional approach are: (Water and Sanitation Program, 2007)

- It is constituted specifically to provide a particular service (solid waste processing or disposal).
- It is governed by a board of directors, a council or an executive body which is unique to the organization.
- It is usually not dependent on taxes for funding, but raises fund through service tipping fees paid by partnering local bodies.
- It may or may not involve the participation of a private sector service provider.
- It often requires special legislation and ordinances for its establishment.

Various implementation arrangements can be applied to establish a Regional SWM project. Regional projects can be implemented either through: (Zhu, 2008)

- Inter Municipal Agreements
- Authorities, Trusts and Special Districts
- Non-profit Public Corporation
- Regional Council
- Private Sector Participation

Designing a holistic sewer and trash management system for temple tourism requires a careful balance of preserving the sanctity of sacred sites, ensuring environmental sustainability, and accommodating the needs of visitors. Here are some key considerations:

1. Respectful Integration: Ensure that waste management systems are discreetly integrated into the temple environment, preserving the spiritual ambiance and aesthetic beauty of the site.

2. Sustainable Practices: Implement eco-friendly practices such as composting, recycling, and wastewater treatment to minimize environmental impact and promote sustainability.
3. Visitor Education: Educate visitors about proper waste disposal and the importance of maintaining the cleanliness and sanctity of temple sites through informative signage and awareness campaigns.
4. Innovative Technology: Utilize advanced technology like smart bins, automated waste collection systems, and real-time monitoring to efficiently manage waste without disrupting the visitor experience.
5. Community Involvement: Engage local communities in waste management initiatives, fostering a sense of responsibility and ownership towards maintaining cleanliness around the temple area.
6. Cultural Sensitivity: Respect cultural and religious practices in waste management protocols, ensuring that any measures taken align with the temple's customs and traditions.
7. Robust Infrastructure: Develop strong infrastructure for sewer systems and waste management facilities that can handle the influx of tourists while maintaining high hygiene standards.
8. Health and Safety: Prioritize the health and safety of both visitors and workers by adhering to strict hygiene standards and safety protocols in all waste management activities.
9. Regulatory Compliance: Comply with local, national, and international regulations to ensure legal adherence and build public trust in the waste management system.
10. Continuous Improvement: Regularly assess and update the waste management strategies to accommodate changes in visitor numbers and emerging best practices in environmental management.

Objectives of Research:

The main aim of research is to holistically design sewer and trash management of Tuljapur tourism city.

- To study the process of waste generation and disposal
- To monitor, Quantify and characterize solid and liquid waste for the period of two years
- To study the existing system of the sewer layout of Tuljapur City
- To collect baseline data for physical and chemical characteristic of Sewer water
- To design a sewer and solid waste management system for efficient environment

Study Area:

The city of Tuljapur is situated in 18.0° north latitude and 76.08°east longitude, fourty four Km to the west of Solapur, is one of the most frequented places of pilgrimage not only in the State of Maharashtra but also in the India. TuljaBhavani temple is a 700 year old temple with deity idol placed in center of the complex, which pivots the entire complex. It is a very important for this town‟s economy. The temple has limited accessibility as it is situated atop a hill, it is still located in the rural hinterland. It is one of the 3 and half „Shakti peths‟ in Maharastra.

It is the head-quarters of the taluka bearing the same name and has, according to the Census of 2001, a total population of 31,714 and 6,563 households. The town with an area of 416.44 hacter. in beautiful Balaghat mountain ranges.

Figure I: Location Map: India- Maharashtra- Osmanabad District- Tuljapur Tal.

Methodology to be adopted:

The methodology chapter of this research on holistic waste management in temple towns explores the integrated approaches used to address waste challenges in sacred environments. This chapter details the systematic processes, from waste audit and community involvement to the implementation of sustainable practices and advanced technologies. By combining quantitative and qualitative methods, including surveys, field observations, and stakeholder interviews, the study aims to develop a comprehensive understanding of waste generation, management practices, and their socio-environmental impacts. This holistic approach ensures that the waste management strategies align with cultural, spiritual, and ecological considerations, promoting sustainable development in temple town

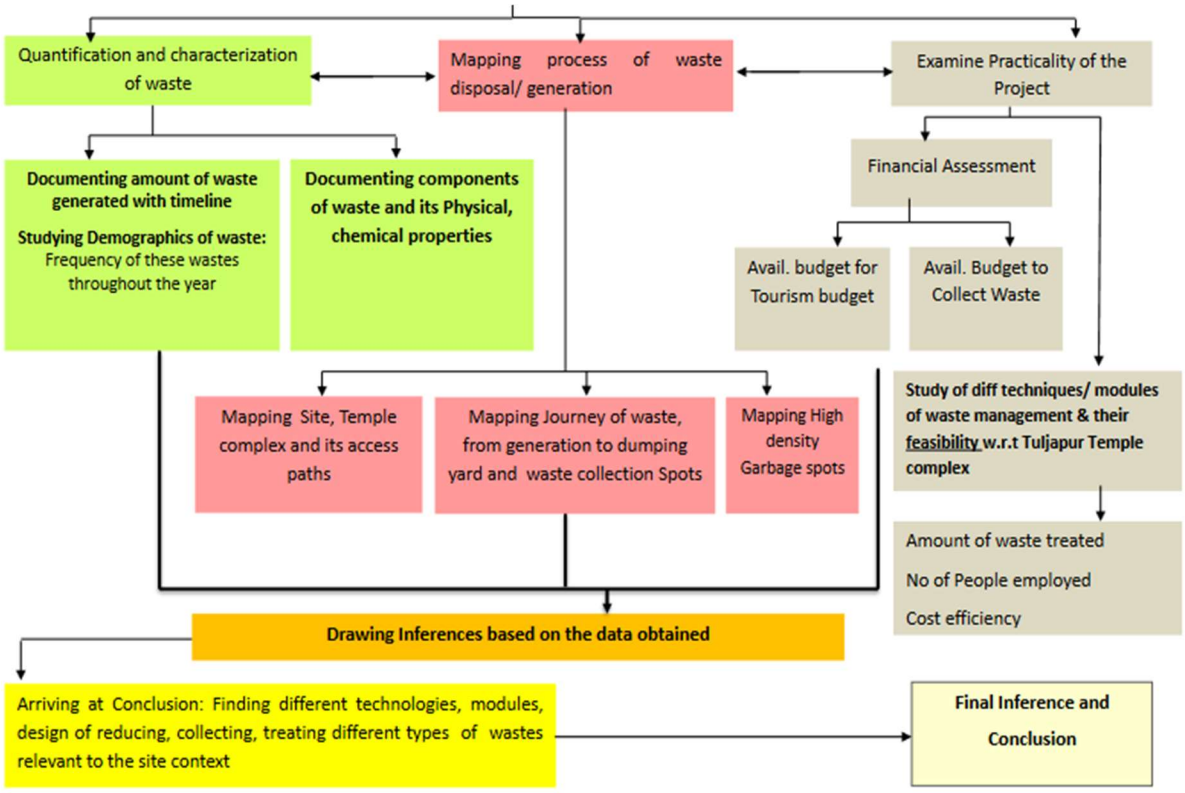
Quantification and characterization of waste
Mapping process of waste disposal/ generation
Examine Practicality of the Project
Documenting amount of waste generated with timeline
Studying Demographics of waste: Frequency of these wastes throughout the year
Documenting components of waste and its Physical, chemical properties
Financial Assessment
Avail. budget for Tourism budget
Avail. Budget to Collect Waste
Mapping Site, Temple complex and its access paths
Mapping Journey of waste, from generation to dumping yard and waste collection Spots
Mapping High density Garbage spots
Study of diff techniques/ modules of waste management & their feasibility w.r.t Tuljapur Temple complex
Amount of waste treated
No of People employed
Cost efficiency
Drawing Inferences based on the data obtained
Arriving at Conclusion: Finding different technologies, modules, design of reducing, collecting, treating different types of wastes relevant to the site context
Final Inference and Conclusion

Figure: Methodology to be adopted

Importance of Study and its Societal Applications:

Effective waste management in pilgrim towns plays a significant role in enhancing the quality of life for both residents and visitors. Here are some key societal applications and their importance, along with references:

Societal Applications:

1. **Improved Public Health**: Proper waste management practices prevent the spread of diseases by reducing the accumulation of waste, which can serve as breeding grounds for pests and pathogens. According to the World Health Organization (2020), effective sanitation and waste management are crucial for public health, particularly in densely populated areas like pilgrim towns.
2. **Enhanced Environmental Quality**: Implementing sustainable waste management solutions helps to protect the natural environment. This includes reducing pollution in water bodies, soil, and air, thus preserving the ecological balance. A study by UNEP (2019) highlights the importance of waste management in maintaining environmental quality and biodiversity.
3. **Community Engagement and Awareness**: Waste management initiatives often involve community participation, which fosters a sense of ownership and responsibility among residents. Educational programs and awareness campaigns can encourage proper waste disposal practices and promote recycling. UN-Habitat (2019) emphasizes the role of community engagement in successful waste management systems.
4. **Economic Benefits**: Effective waste management can lead to economic opportunities through the creation of jobs in waste collection, sorting, and recycling. Additionally, it can attract more tourists by ensuring a clean and pleasant environment, thereby boosting local businesses and the economy. According to the World Bank (2018), efficient waste management systems can contribute significantly to economic development.
5. **Cultural and Aesthetic Preservation**: Maintaining cleanliness in pilgrim towns preserves the cultural heritage and aesthetic beauty of these sacred sites. This not only enhances the visitor experience but also ensures that the cultural significance of the sites is respected and maintained for future generations. UNESCO (2018) notes the importance of cultural preservation in the context of waste management.

Other micro socitial applications are as following: **Resource Recovery and Recycling**: Implementing programs that focus on recovering resources from waste materials can significantly reduce the overall waste generated. Recycling initiatives can turn waste into valuable commodities,

such as paper, plastics, and metals. This not only benefits the environment but also creates economic opportunities for local communities (EPA, 2019).

Waste-to-Energy Programs: Developing waste-to-energy facilities can convert non-recyclable waste into usable energy, such as electricity or heat. This can help meet the energy needs of pilgrim towns sustainably and reduce the reliance on non-renewable energy sources (International Renewable Energy Agency, 2020).

Zero Waste Initiatives: Encouraging a zero-waste lifestyle among residents and visitors can drastically reduce the amount of waste generated. This includes promoting the use of reusable items, reducing single-use plastics, and composting organic waste (Zero Waste International Alliance, 2018).

Smart Waste Management Systems: Leveraging technology to create smart waste management systems can improve efficiency and effectiveness. This includes using sensors for real-time monitoring of waste bins, GPS tracking for waste collection vehicles, and data analytics to optimize collection routes and schedules (Smart Cities Council, 2021).

Green Procurement Policies: Implementing green procurement policies can ensure that the products and services procured by local authorities and businesses are environmentally friendly. This can include buying products made from recycled materials, opting for biodegradable items, and prioritizing suppliers with sustainable practices (United Nations, 2019).

Public-Private Partnerships: Forming partnerships between local governments and private companies can enhance the efficiency of waste management services. These partnerships can bring in expertise, innovation, and investment from the private sector while ensuring public oversight and accountability (World Economic Forum, 2018).

Educational Programs and Workshops: Organizing educational programs and workshops on waste management and sustainability can raise awareness among residents and visitors. These programs can teach practical skills, such as composting and recycling, and promote environmentally responsible behaviors (UNESCO, 2019).

Cleanliness Drives and Campaigns: Regular cleanliness drives and campaigns involving local communities, schools, and religious organizations can help maintain the cleanliness of pilgrim towns. These initiatives can foster a culture of cleanliness and environmental stewardship (Clean India Mission, 2019).

Eco-Friendly Infrastructure: Developing eco-friendly infrastructure, such as green buildings and sustainable public spaces, can minimize waste generation and enhance the overall sustainability of pilgrim towns. This includes using renewable energy sources, rainwater harvesting systems, and green construction materials (Green Building Council, 2020).

Proposed Workplan and Structure of the Study : (Year-Wise plan and targets to be achieved)

First year

- Collection of the references and literature review.
- Collection of Primary and Secondary data.
- Participation in the seminars/Conferences/Workshops on relevant topic.

Second year

- To attend the seminars/Conferences/Workshops on relevant topic.
- Finalization of Assessment tools and methods.
- Pilot Data collection.
- Data Analysis.
- To publish the work in reputed journals.

Third year

- Inferences and Writing
- To publish the work in reputed journals.
- To submit the work to the authority.

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